some flexible material (Fig 1, *b*, *b'*). A second rod exhibits its longitudinally fibrous woody body bound round transversely with a different bark (Fig. 2, *b*). Prof. Schwendauer, who has made a microscopical examination of these interesting rods, confirms the fact of their having been subjected to artificial treatment. He supplies in Fig. 4 an enlarged view, showing how the artificially-produced section cuts across the structure of the wood. We can hardly doubt that we have here portions of a piece of the rude basket-work, the construction of which is among the earliest practised of the arts of savage peoples.

With regard to the mode of occurrence of the Wetzikon lignite deposit, in which these singular remains were found, two woodcuts, which we transfer from Dr. Heer's book, will suffice to make the matter perfectly clear. The first is an ideal section across the Valley of Utznach, which shows the lignites in question (*b*) resting on upturned Miocene strata (*a*) and covered by beds of pebbles (*c*) and erratic blocks (*d*). From this section it appears that a vast amount of denudation has taken place since the formation of the beds of lignite and their being covered up by deposits showing signs of glacial origin, for the outcrop of the lignites occurs at a height of 100 yards above the bottom of the valley. The second section shows the nature of the stratified materials, sand, loam, and pebble-beds (*c*, *d*, *f*, *g*) with which the lignites (*b*, *e*) are interstratified and covered—a number of erratic blocks (*h*), evidently derived from the Alps, surmounting the whole mass.

That these lignites of Wetzikon with their relics of human workmanship are of great antiquity there is the plainest proof; that they are, however, of more recent date than the principal mass of the glacially-derived materials occurring in the great Swiss valley is rendered clear by their undoubted superposition to these deposits, which is seen at a number of different points; but that moraine matter and erratic blocks have been deposited *above* them, either by glaciers or icebergs, there seems to be no room for doubting. We would venture to suggest, in conclusion, however, that the greatest possible caution ought to be exercised in attempting to correlate these Alpine deposits with the glacial beds of our own country.

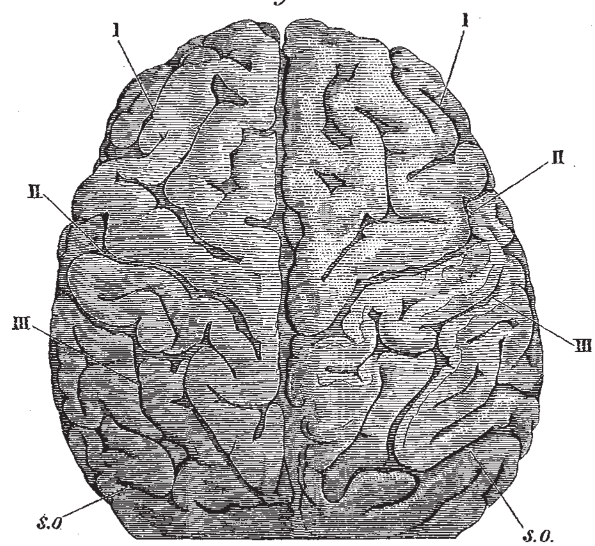
J. W. J.

THE BRAIN OF THE GORILLA

THE anatomy of the brain of the gorilla has been hitherto absolutely unknown. From the valuable photographs published by Dr. Bolau in his recent memoir on the anatomy of the gorilla, which was referred to in last week's issue of this journal (p. 127), I am enabled to give a brief account of its external anatomy, to reproduce the illustrations of its form, and to compare it with the brain of man and the other anthropomorpha. There are three views of the brain, the upper, the outer, and the inner surfaces, figures of which are here given, and a careful description of the sulci, by Dr. Ad. Pansch, is appended.

When seen from above the brain presents a broad ovoid figure, the greatest transverse diameter opposite the supramarginal convolutions, and very nearly two-thirds of its length from the anterior extremity; the frontal lobes are broad, and show a remarkable approximation to the square form of the human brain. In the lateral view it has moderate depth, the arching of the upper surface is but slight, and the highest point would seem to be about midway between the centre of its length and the broadest part. The dimensions are given, length = 100 mm., breadth = 87 mm., and the depth = 70 mm.; but the last certainly includes the cerebellum, for which an allowance of one-fifth may very properly be made, which will reduce the depth to 56. In the orang the three proportions are respectively 100, 78, and 50; in the chimpanzee 100, 84, and 66; in the bushwoman 100, 77, and 62. The breadth of the gorilla's brain here is notable, but in connection with this it may be pointed out that the bushwoman has as great a relative breadth of brain as the European, in whom the numbers are 100, 77, and 69, and

Fig. 1.

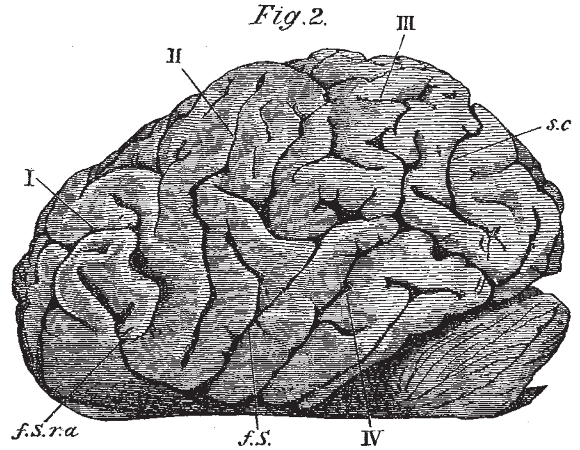


Upper view of the brain of the Gorilla. I. Sulcus, præ-central; II. Fissure of Rolando; III. Intra-parietal sulcus; *s.o.* External perpendicular fissure.

that the great and more valuable contrast is to be found in the depth; in the case of the orang (from Dr. Rolleston's paper) it would seem that it must be too low, probably from the flattening that follows removal of the brain from its natural cavity.

Hence conclusions drawn from the shape of the brain

Fig. 2.



Outer surface of the brain of the Gorilla. I. II. III. *s.o.* as before; IV. Parallel fissure; *f.s.* Sylvian fissure, posterior branch; *f.s.r.a.* Ant. branch of the same.

itself are from this very circumstance liable to error, and for this purpose casts of the interior of the cranium are the only reliable guides. Referring to those in the Hunterian Museum, that of the gorilla as compared with man is seen to be characterised by want of height, flatness of the vertex, and narrowed frontal lobes; compared with

the orang, in the latter the frontal lobes are more compressed, giving a pointed form to the frontal extremity, and the occipital lobes are larger and more rounded, so that the figure is pear-shaped rather than ovoid; but the vault is decidedly more lofty and better arched; also the orbital concavity is less marked in the orang, so that any deficiency in the lateral development of the frontal lobes might very well be compensated by their downward extension. The chimpanzee and gorilla, however, exhibit a very great resemblance in shape and proportions, though the former has somewhat more compressed frontal lobes, a greater development of the occipital region, and apparently greater width, so that the cast looks more globular than that of the gorilla.

The *corpus callosum* is of good length, but rather thin; its proportion, taking the length of the brain as 100, is 41, and its average thickness appears about one-twelfth of that; in the chimpanzee the length is 39 and the thickness one-eleventh; in the orang, 44; and in man, 40; thickness, one-thirteenth.

The convolutions are strongly marked; in a general view they are slightly more subdivided than in the chimpanzee, but in complexity and asymmetry the orang exceeds the gorilla to about the same extent.

Outer Surface of the Hemisphere.—The posterior branch of the Sylvian fissure extends upwards and ends in the usual bifurcation, nearly at the junction of the middle and posterior thirds of the hemisphere, and almost half of the height from the lower margin; judged by this, the fissure is more oblique than in man, less so than in either orang or chimpanzee. The short anterior limb is very faintly marked in front of the insula, but its ending is distinct, bifurcated, on the outer side of the frontal lobe. The insula has its fore part uncovered in the bottom of the fissure. The external parieto-occipital fissure travels over the outer surface to within a very short distance of the lower margin of the hemisphere; its hinder margin, prolonged forwards, gives rise to a convex operculum in about its lower two-thirds, very much resembling that of the chimpanzee, although somewhat more sinuous. The fissure of Rolando is very oblique, the lower end is remarkably forward, being actually in front of the tip of the temporo-sphenoidal lobe (probably part of this is due to the position of the brain), and the upper end reaches the longitudinal fissure behind the centre of the hemisphere; the angle formed by the two fissures is very little more than a right-angle, 95°.

The length of the hemisphere being 100, the distances in a horizontal line from the anterior extremity to the upper end of the fissure of Rolando, *i.e.*, the extreme length of frontal lobe, being *a*, thence to the parieto-occipital fissure, length of parietal lobe, *b*, and from that to the hinder extremity, occipital lobe, *c*, we get—

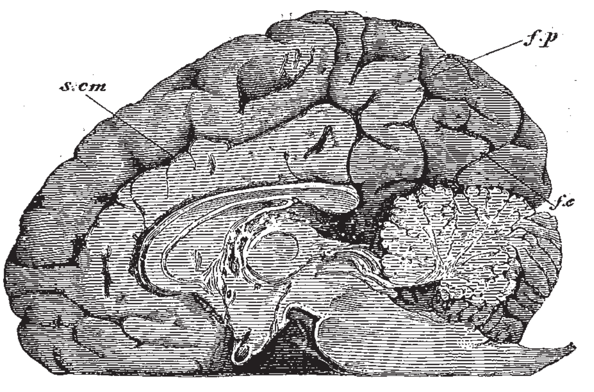
	a.	*b.*	*c.*
Gorilla ...	57	29	14
Chimpanzee ...	49	28	23
Orang ...	52	27	21
Bushwoman ...	65	17·5	17·5
European ...	57	23	30

The length of the frontal and the smallness of the occipital lobes are especially noteworthy.

The convolutions of the frontal lobe present their typical arrangement: the ascending frontal is very simple, following in easy curves the fissure of Rolando, and marked only by one slight indentation opposite the superior frontal sulcus; it is bounded in front for the lower half by the præ-central sulcus (Ecker) from which the distinct and strongly-bent inferior frontal sulcus runs forwards to the tip of the lobe. The superior frontal sulcus has its characteristic T shape, the top of the T being placed vertically in front of the upper half of the foregoing convolution, and the second limb sent forwards almost straight for about two-thirds of the distance to the anterior extremity between the upper and middle frontal convolutions. Of the three horizontal gyri, the upper springs by a narrow root from the ascending frontal close to the margin, and shows plainly the indications of the longitudinal division into two; the middle is much narrower, connected to the ascending by a pedicle between the præ-central and superior frontal sulci; and the inferior frontal is well developed, arching over the anterior limb of the Sylvian fissure, and considerably folded. Compared with the chimpanzee, the upper is narrow, the middle and lower larger and more subdivided. The orang throughout the whole lobe exhibits a greater richness of convolution.

The convolutions of the parietal lobe are very definitely and strictly marked off, and at the same time they are decidedly the most developed of the whole brain, far exceeding the chimpanzee, and not inferior to the orang. The intra-parietal sulcus, springing from the Sylvian fissure near its hinder end, runs forwards and then upwards, round the front of the supra-marginal lobule, parallel to the fissure of Rolando, as far as the centre of that, when it turns backwards at an obtuse angle, continues, approaching slightly the longitudinal fissure, and debouches into the external parieto-occipital fissure; from the angle which it forms, the customary prolongation, giving off two or three smaller branches, is sent upwards

Fig. 3.



Inner surface of the brain of the Gorilla. *f.p.* internal parieto-occipital fissure; *f.c.* Calcarine fissure; *s.cm.* Calloso-marginal fissure.

in continuation of the ascending portion, and dividing the ascending parietal convolution from the parietal lobule almost completely; the interruption to this fissure about its bend which is seen so often in human brains I have observed only in the orang. The ascending parietal convolution is much more developed than the ascending frontal, and it presents a marked indication of a longitudinal fission; the lower end has the usual triangular expansion split into two (superior marginal convolution of Gratiolet). The parietal lobule is large and divided into an outer and an inner portion, the latter showing further subdivisions, in this condition approaching more to the human brain than either orang or chimpanzee. The supra-marginal lobule is more developed than in either chimpanzee or orang, and divided into three portions by a triradiate sulcus, but its proportion and the amplitude of its gyri are much inferior to the human brain. The angular convolution springs from the upper end of the supra-marginal lobule by a narrow bent piece; the descending branch here differs from the chimpanzee and orang in being cut off from the middle temporo-sphenoidal convolution and running backwards into the middle occipital convolution, constituting the anterior boundary of the external parieto-occipital fissure.

The occipital lobe is by no means richly convoluted,

the three gyri are marked off, the upper being broad and the lower narrow.

The temporo-sphenoidal lobe presents nothing remarkable; the parallel fissure is continuous and simple, running up behind into the angular convolution, where it is cleft, one branch extending downwards parallel to the lower part of the external parieto-occipital fissure, and cutting off the middle temporo-sphenoidal gyrus from the descending ramus of the angular and the second annectent convolutions. The upper convolution is simple; the middle is broader and more folded, the inferior is separated by a well-marked sulcus from the middle.

The first external annectent gyrus is seen issuing from under cover of the operculum, and passing forwards and inwards to the parietal lobule; this is an approach to the orang, in which the gyrus is normally superficial, and an advance on the chimpanzee, in which it occurs only at times. The second does not appear at all; the third is to be recognised nearer the lower margin of the hemisphere and below the lower end of the external parieto-occipital fissure, but the extension of the parallel fissure separates it superficially from the middle temporo-sphenoidal convolution; below this the small fourth appears, uniting the lower occipital and third temporo-sphenoidal convolutions.

Inner Surface of the Hemisphere.—The calloso-marginal fissure pursues its usual course and turns upwards opposite the hinder end of the corpus callosum, sending a branch backwards between the convolution and the quadrate lobule; it is interrupted opposite the anterior extremity of the corpus callosum by a small gyrus, a very frequent condition in human brains; from it a few small indentations pass up into the marginal convolution. The callosal convolution is simple: at the fore part there is a hint of the longitudinal division which obtains here sometimes in man, and it is more broken up when it passes under and is joined by the quadrilateral lobule. The marginal convolution is larger and more divided, but both of these are simpler than in the orang. The quadrate lobule is divided into about four small gyri, and is much larger than in the orang, where the calloso-marginal fissure opens into the surface very near the parieto-occipital, and the lobule is almost obliterated. The internal parieto-occipital fissure does not join the calcarine below, so that a distinct inferior internal annectent convolution is present, and at the upper end the upper internal annectent convolution can be seen coming out of the fissure and joining the upper posterior angle of the quadrate lobule. The calcarine fissure is usual, so also is the fissure of the hippocampus. The occipital lobule is divided into three gyri transversely by two furrows running the upper from the parieto-occipital, and the lower from the calcarine fissures nearly across; this is in marked contrast with the arrangement of the human brain where the gyri run from apex to base, being subject, however, to great variety. The gyri on the under surface of the occipital and temporo-sphenoidal lobes cannot be seen.

The resemblance between this brain and the chimpanzee's is striking both in its shape and the arrangement of the convolutions, so much so that Gratiolet's description of the latter would serve also for many parts of the gorilla's brain. The chief points of difference between the two are mainly in favour of the gorilla, *e.g.*, the greater length and breadth of the frontal lobe, a greater development of the middle and lower frontal and of the parietal convolutions, especially of the supra-marginal lobule and the appearance of the first external annectent gyrus. On the other hand the chimpanzee appears to have some advantage in the important point of greater vertical height. On the whole, the comparison seems to indicate a development of the chimpanzee type of brain and to give it a higher rank than that.

In one particular character it approaches the orang, the partial appearance of the annectent convolution, but the differences in shape, the more perfect operculum, the lesser complication of the frontal and occipital convolutions and the greater symmetry far outweigh the resemblances and denote its proper position as with the chimpanzee, although somewhat nearer the orang than that.

Gratiolet placed the gorilla with the baboons by reason of its elliptical form and the supposed want of development of the frontal and great excess of the occipital lobes; but we see now that of all the anthropomorpha the gorilla is characterised by the most extensive frontal lobe and smallest occipital; in addition to which the richness of the convolutions and the breadth of the frontal region also separate it farther from the baboons than the chimpanzee.

It is certainly open to great doubt whether this diminution of the occipital lobe is at all an ascensive step in the cerebral conformation, in fact, the comparison of the respective proportions in the bushwoman and the European points distinctly in the opposite direction; and it is to be noticed that the great relative length of the frontal lobe is entirely due to this dwarfing of the occipital, for the proportion of the frontal to the parietal is no greater in the gorilla than in the others; and the highest type is to be sought rather in the co-ordinate development of all the lobes and not in the predominance of any one; so that regarded by this standard the gorilla's brain shows one marked feature of inferiority.

It should be remarked that Dr. Pansch, whose judgment must carry great weight, is disposed to regard the divergences from the chimpanzee as sufficient to establish a distinct type of brain in the gorilla.

In the comparisons above instituted, the brain of the bushwoman so carefully and elaborately described by Mr. Marshall in the *Philosophical Transactions* for 1864, that of the chimpanzee described with photographs by the same author in the *Natural History Review* for 1861, and that of the orang in the same journal by Prof. Rolleston have been taken as standards, supplemented by reference to the specimens in the Hunterian Museum.

G. D. THANE

MUSEUM SPECIMENS FOR TEACHING PURPOSES [1]

IT is now generally admitted that a thorough and practically useful knowledge of the form and other properties of natural bodies can only be acquired by an examination of such bodies themselves. The difference between knowing a thing by description only and knowing it from personal acquaintance need scarcely be insisted on.

All teaching, therefore, of the physical properties, especially the form, texture, colour, and relation to one another of the component parts of any natural object, whether organised or inorganic, should be illustrated by reference to the object itself. The more completely the student is enabled to examine it, the more thorough will his knowledge of it be.

In the Department of Biology, which is that to which my remarks must now be limited, very much valuable and practical teaching can certainly be given without the possession of a museum or a single permanent preparation. The commoner and easily accessible animals and plants furnish materials for study and demonstration, which, when done with, can be thrown away and replaced as occasion requires. But it is often desirable to preserve specimens for a considerable time or permanently, either on account of their intrinsic rarity, causing difficulties in procuring them when needed, or on account of the labour and skill which may have been expended upon their proper display, and which it is not desirable to have wasted.

Hence the necessity for museums as most important adjuncts in connection with all establishments for teaching biology.

[1] Lecture at the Loan Collection of Scientific Apparatus, South Kensington, July 26, 1876, by Prof. W. H. Flower, F.R.S., Conservator of the Museum of the Royal College of Surgeons of England.